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AUTHOR Maley, Donald
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ABSTRACT

This paper is a discussion of a 4-year research and development project dealing with the cluster concept approach to vocational education. The concept is a form of vocational education that prepares the individual to enter into gainful employment in a number of occupations which have sufficient commonalities in human requirements and kinds of work to permit a high degree of mobility within the cluster. Its principal mission was to provide job entry skills and second level skills in a series of related areas. This movement was prompted by the increasing mobility of people, the need for mobility within an industry, the need to adopt to technological changes, and the problem of selecting one's life work. The first phase of the project was devoted to a number of important probes and developments, the second phase to teacher education and the preparation of curriculum materials, the third to implementation and further development through field testing and evaluation at the secondary level, and the fourth to implementation and development through testing and evaluation including placement and followup of subjects. (Author/GEB)

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The Cluster Concept Program as an Approach to Vocational Education at the Secondary School Level

by

Dr. Donald Maley
Professor and Head

Industrial Education Department
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A Presentation at the Rutgers University
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THE CLUSTER CONCEPT PROGRAM AS AN APPROACH TO VOCATIONAL EDUCATION AT THE SECONDARY SCHOOL LEVEL

BY

Dr. Donald Maley
Professor and Head
Industrial Education Department
University of Maryland

May 2, 1969

A Presentation at

The Rutgers University

Recent Innovations in Curriculum Design
and Instructional Materials Conference

This discussion is a report of a four-year research and development project dealing with the cluster concept approach to vocational education. The project was conducted by the Industrial Education Department of the University of Maryland with funds provided by the Bureau of Research of the U. S. Office of Education in the Department of Health, Education, and Welfare.

The Cluster Concept of
Vocational Education
at the Secondary Level

This presentation will concern itself with the background, point of view, and development of the cluster concept project in vocational education being carried out in the Industrial Education Department at the University of Maryland.

The cluster concept as envisioned in this project is a form of vocational education that prepares the individual to enter into gainful employment in a number of occupations which have sufficient commonalities in human requirements and kinds of work to permit a high degree of mobility within the cluster. The cluster program was not conceived as a means of providing master craftsmen in any area. Its principal mission was to provide job entry skills and second level skills in a series of related areas. Chart I is a graphic presentation of the developments in the early phases of the cluster approach at Maryland.

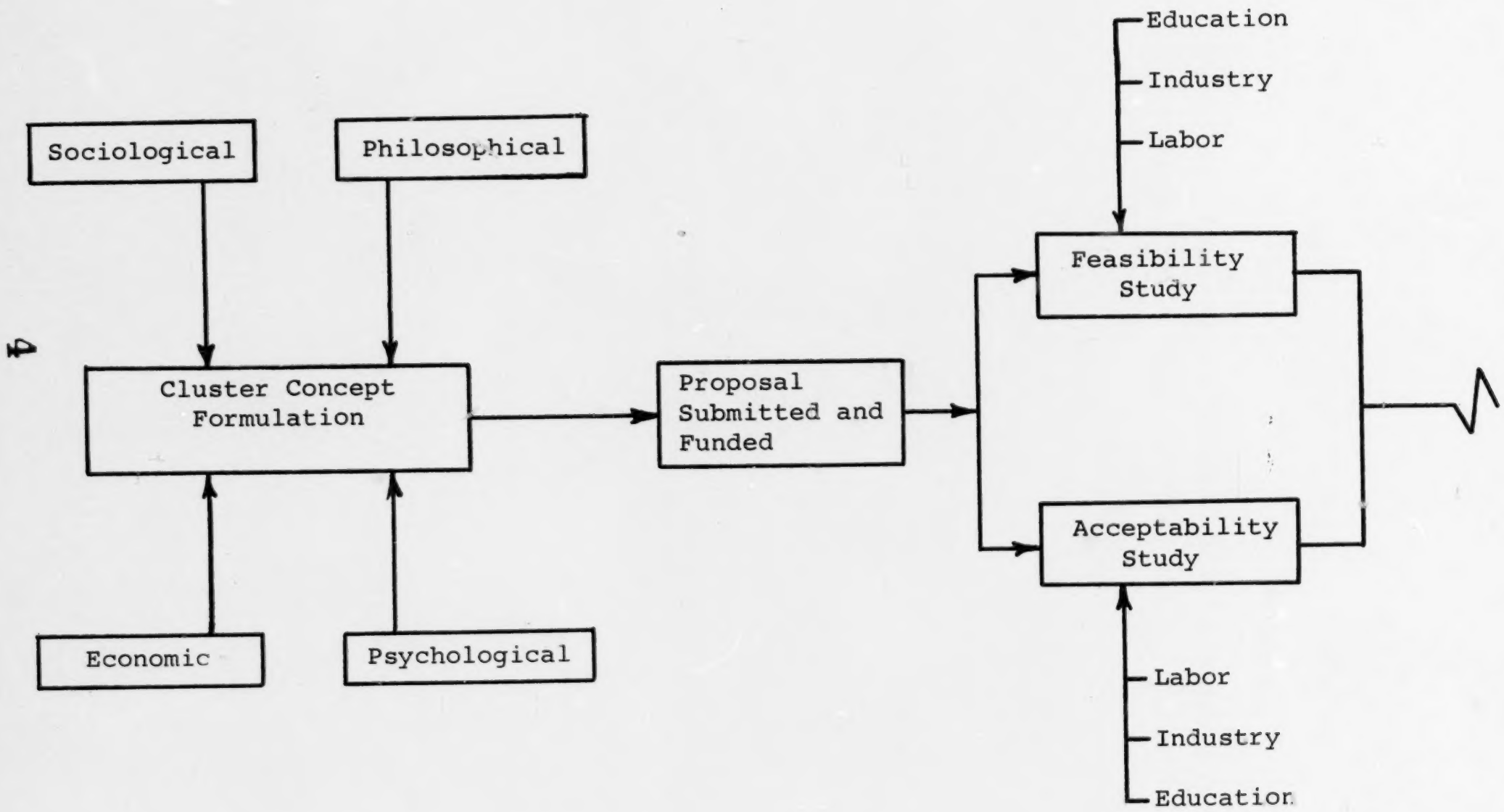
The movement towards such a project dealing with clusters of occupations was prompted by several obvious conditions as expressed in the literature and by competent observers of the contemporary scene.

1. The increasing mobility of people on a geographical base presented a convincing argument. This geographical mobility and vocational education were discussed by

THE CLUSTER CONCEPT IN VOCATIONAL EDUCATION

PRELIMINARY PROCEDURES MODEL

CHART I



Kimball Wiles in his text The Changing Curriculum of the American High School.

> Vocational education can no longer be planned solely in terms of the community in which a high school exists. Over half of the average school's graduates will migrate to another community, and will go to another state. Seemingly the wisest step for curriculum planners to take, then, is to study industrial and commercial operations and plan in terms of clusters of competencies. When a student has developed a particular set of abilities he may enter a variety of related occupations.[1]

2. A second need was to provide the individual with effective mobility potential within an industry. That is, in an industry that has a variety of processes whose demand for personnel tends to shift from day to day or month to month, there is the problem of job coordination to provide for full employment. This requires personnel with a flexible and diversified occupational preparation. Such within industry mobility calls for transferable skills that are common to a variety of jobs. This point was made by James E. Russell in the publication Automation and the Challenge to Education.

> ...therefore, to the extent that the school tries to develop employable skills, it should aim at transferable skills, and it should not attempt

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[1]Kimball Wiles, The Changing Curriculum of the American High School (Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1963), p. 126.

> to train persons for specific jobs that are only temporarily open.[2]

Edwin L. Rumpf in an article titled "Training the Manpower Catalyst" stressed this same point as follows.

> Industry needs workers who are flexible, workers who have a field of skills and basic education that will enable them to adapt rapidly to occupational changes.[3]

3. A third area of concern was identified with the need to adapt to technological changes. Every age has had to cope with this problem, but never before in the history of man has the change been so rapid and so revolutionary. This raises a serious question regarding the nature of vocational or any other form of education. The following statement from The Pursuit of Excellence describes the problem of occupational education in such a society.

> In this day of technologies that become antiquated overnight, it is hazardous to predict a favorable future for any narrow occupational category. There will be economic advantage to the individual in acquiring the kind of fundamental training that will enable him to move back and forth over several occupational categories.[4]

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[2]James E. Russell, "Educational Implications of Automation as Seen by an Educational Policy Planner," Automation and the Challenge to Education, Proceedings of a symposium sponsored by the Project on the Educational Implications of Automation (Washington: National Education Association, 1962), p. 42.

[3]Edwin L. Rumpf, "Training the Manpower Catalyst," Manpower and Training Needs of the Food Industry, Report of a National Conference, April 22-24 (Washington: Government Printing Office, 1964), p. 10.

[4]Rockefeller Brothers Fund, Inc., The Pursuit of Excellence, (Garden City, New York: Doubleday and Company, 1958), p. 10.

4. A fourth category of need was in regard to the problem of selecting one's life work. The facts are obvious and there is a need to examine the question as to when is an individual prepared and capable of selecting an occupation involving considerable training and internship. The argument usually centers around the matter of when should the student start his occupational preparation, i.e., the 9th, 10th, 11th, 12th, 13th, or 14th grade. Perhaps the issue should be discussed with regard to the kind of program to be offered. An interesting comment in this area is presented in the U.S.O.E. Publication Education for a Changing World of Work.

> Basic vocational education programs should be designed to provide education in skills and concepts common to clusters of closely related occupations. The curriculum should be derived from analyses of the common features of the occupations included. These students should receive specialized or more advanced vocational training later in post-high school programs, apprenticeship, or on-the-job experiences.[5]

The best interest or aptitude inventories do not indicate specific occupations for persons taking such tests. The obvious fluctuations in interests among young people further complicates the problem.

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[5]U.S. Department of Health, Education and Welfare, Office of Education, Education for a Changing World of Work. (Washington: Government Printing Office, 1963), p. 227.

However, the principal issue still remains. What kind of an education should the individual have who does not go on to college or other form of higher education and who has not definitely decided on an occupation appropriate to conventional vocational preparation?

It was felt that the school should provide such persons (and there are many of them) with a flexible program that would leave the doors to higher education open and at the same time provide the individual with a broad range of occupational entry opportunities.

Another factor that cannot be disregarded deals with the role of industry in the preparation of workers with the specific skills related to their jobs. What kind of a high school occupational preparation experience is most suitable in those instances--or for those students who enter the armed services, where a great deal of technical learning takes place?

The essential problem of the Cluster Concept Project at the University of Maryland was one of examining a kind of program that would address itself to a number of obvious and important clues regarding employment, unemployment, preparation for a livelihood, change, educational opportunities and factors in selecting an occupation.

Certain assumptions regarding the program were made from the beginning.

1. It was felt that the cluster program should be a two-year sequence for grades 11 and 12.
2. It was felt that the class time would not exceed two periods or hours per day.
3. It was felt that the general student body (non-college and non-conventional vocational) would be a prime target group.
4. It was felt that the program with a maximum of two hours daily would permit the student to remain in the main stream of education and at the same time achieve a broad level of job entry.

The Maryland Cluster Project is in its fourth year of operation. Each year has dealt with a separate phase of development and analysis.

Phase One. The first year was devoted to a number of important probes and developments.

1. An exhaustive literature study was made in such areas as related studies, sociological factors, employment trends, economic trends, educational point of view, and potential research procedures.

2. A series of studies aimed at determining the acceptability and feasibility of the cluster idea were conducted. These were structured interview sessions with a number of people representing industry, labor, and education. The results of these early studies were positive on both scores--acceptability and feasibility.

Chart II depicts a series of steps through which the project moved in its actual selection of a series of clusters.

3. The next endeavor by the project team was to make a thorough study of occupations, job requirements, relationships between occupations and systems of classification that might lead to the development of valid occupational clusters.

One of the early procedures in the identification and development of a series of clusters was to review a number of occupational classification indexes. These included the following.

1. Dictionary of Occupational Titles
(U.S. Department of Labor)

2. Classified Index of Occupations and Industries
(U.S. Department of Commerce)

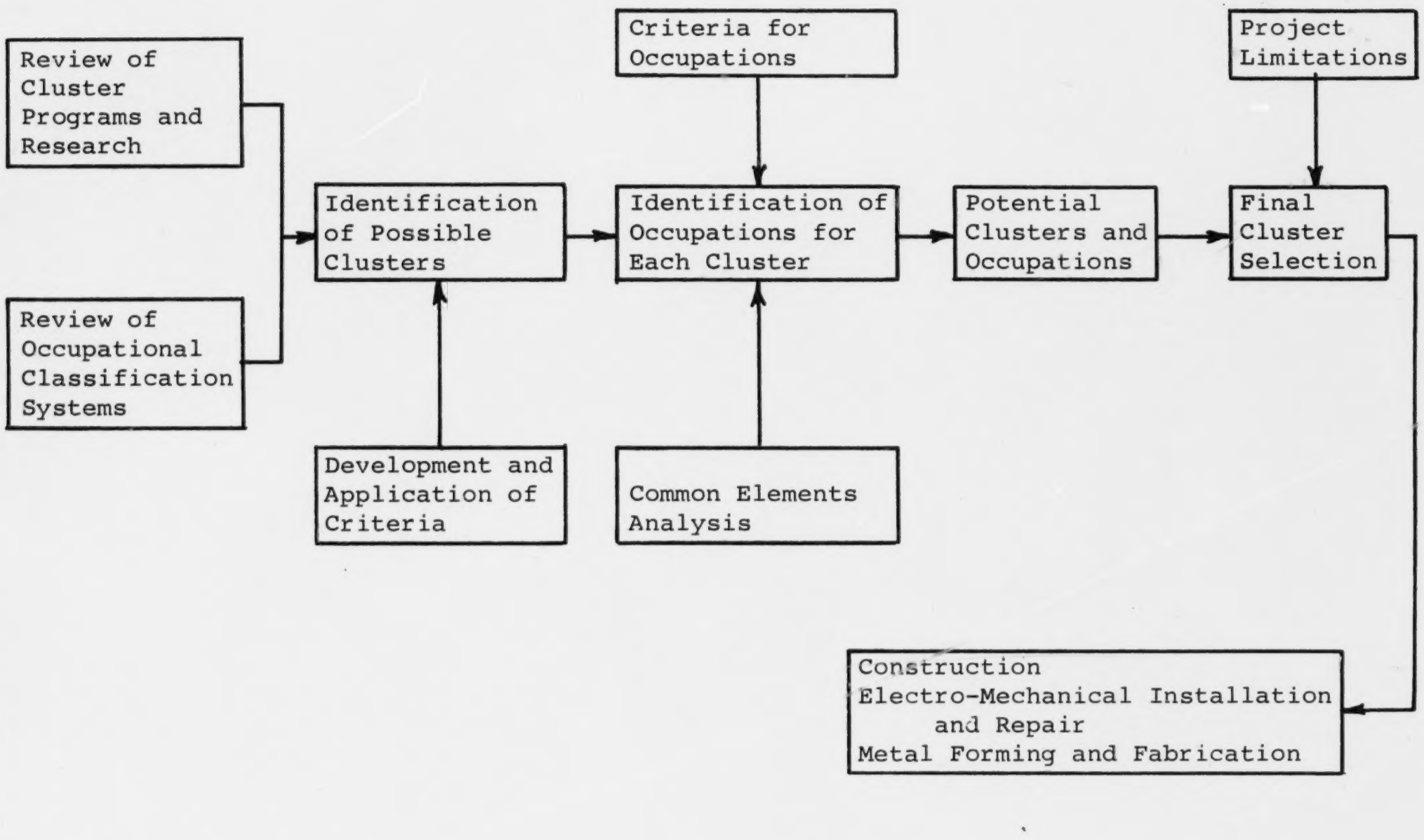
3. Alphabetical Index of Occupations and Industries
(U.S. Department of Commerce)

4. International Standard Classification of Occupations
(International Labor Office, Geneva, Switzerland)

THE CLUSTER CONCEPT IN VOCATIONAL EDUCATION

CLUSTER DEVELOPMENT MODEL

CHART II



5. Manual of Enlisted Military Occupational Specialities
(U.S. Army)

6. Occupational Handbook for Airmen
(U.S. Air Force)

7. A Guide to Occupational Specialities and Schools
(U.S. Marine Corps)

8. U.S. Navy Occupational Handbook
(U.S. Navy)

The actual identification of clusters of occupations that would be valid and cohesive enough to form the base for preparation for the world of work was predicated on a number of independent but related ideas. These included the matter of commonality among selected occupations, criteria for the establishment of a cluster, and a set of criteria that could be applied to the identification of occupations to be included in a cluster.

It was felt that the occupations within a cluster should have certain bonds of commonality among them. A number of such common elements were established and they are as follows.

1. Communications
   - vocabulary
   - symbols
   - drawings and blueprints
   - systems of communication
   - speech
   - English
   - maps

2. Measurement
   - time
   - temperature
   - weight
   - volume

length, width, and depth
meters (electrical and mechanical)
instruments
systems of measurement

3. Skills
   hand
   mental
   machine

4. Mathematics and Science

5. Information
   technical
   operational
   occupational
   economic
   social
   safety
   personal hygiene
   personal standards
   occupational and job standards

The criteria established for the development of the clusters included the following points.

1. The cluster of occupations for purposes of this study should be in the area of vocational-industrial education.
2. The cluster should include occupations that have similarities in the areas of processes, materials and products.
3. The cluster of occupations should be broad enough to include a wide variety of skills and knowledge.
4. The occupations in a cluster should not require more than a high school education for entry employment.

5. The occupations in the cluster should provide the potential for in-plant as well as geographical mobility.

One of the techniques used in establishing clusters was based upon a procedure proposed by Altman and Gagne in their work at the American Institute for Research in Pittsburgh.

a. A list of criteria was prepared to use in selecting occupational clusters and specific occupations within the clusters.

b. A group of possible occupational clusters was developed and several clusters were selected from the group for further analysis.

c. A number of possible occupations were developed for each cluster and those occupations meeting the established criteria were selected for further analysis.[6]

Potential clusters that were identified in the early developments of the study centered in such areas as--

Medical and Health
Home Facilities
Heavy Construction
Light Construction
Machining and Farming
Electricity and Electronics
Communications
Transportation
Food Processing
Office Occupations
Mechanical and Fabrication
Repair Service and Maintenance
Personal Services

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[6]James W. Altman and Robert M. Gagne, First Interim Report on Research on Vocational Skills (Pittsburgh: American Institutes for Research, 1964).

Prior to the acceptance of any occupation as a part of a cluster, the following criteria were applied.

1. The occupation must have a favorable employment outlook.
2. The instruction related to the occupation must be capable of being carried out in a secondary school program.
3. The occupation should permit job entry upon graduation from high school.
4. It must have sufficient skills and information to provide an opportunity for the identification of commonalities with other occupations.
5. The occupations should have opportunities for advancement through further schooling, on-the-job training or apprentice programs.

It soon became quite obvious that the project could best accomplish its purposes and goals by concentrating on a limited number of clusters. This procedure would permit a more thorough analysis of the individual clusters. There also were the problems associated with time, personnel, and facilities that would make it impossible to deal with all of the areas identified in a manner required by the goals and intent of the project.

The final selection of clusters for this project was as follows.

Construction
Electro-Mechanical Installation and Repair
Metal Forming and Fabrication

The following Chart III lists these three clusters along with appropriate occupations in each.

The next steps in the procedure involved an extensive analysis of the three cluster areas in an attempt to determine the type and kinds of human requirements associated with each.

Chart IV identified the various aspects of the procedure that led from the identified cluster areas to the preliminary courses of study.

The first step involved the analysis of the cluster occupations for their task requirements. This involved a detailed study of the individual occupations to determine what was required of the individual. The requirements of the individual were developed along a precise line as illustrated in Chart V, titled "Task Statement Format."

This particular phase of the project involved meticulous attention to detail and endless hours of careful study. The net result of this effort was a series of task statements for each occupation in the three clusters.

OCCUPATIONAL CLUSTERS

CONSTRUCTION

Those occupations dealing with the building of homes

- CARPENTER
- ELECTRICIAN
- MASON
- PAINTER
- PLUMBER

ELECTRO-MECHANICAL INSTALLATION AND REPAIR

Those occupations dealing with installation and repair of electrical and mechanical equipment found in homes and business offices

- AIR CONDITIONING AND REFRIGERATION SERVICEMAN
- BUSINESS MACHINE SERVICEMAN
- HOME APPLIANCE SERVICEMAN
- RADIO AND TELEVISION SERVICEMAN

METAL FORMING AND FABRICATION

Those occupations dealing with machining, bending, and joining of metals

- ASSEMBLER
- MACHINIST
- SHEET METAL WORKER
- WELDER

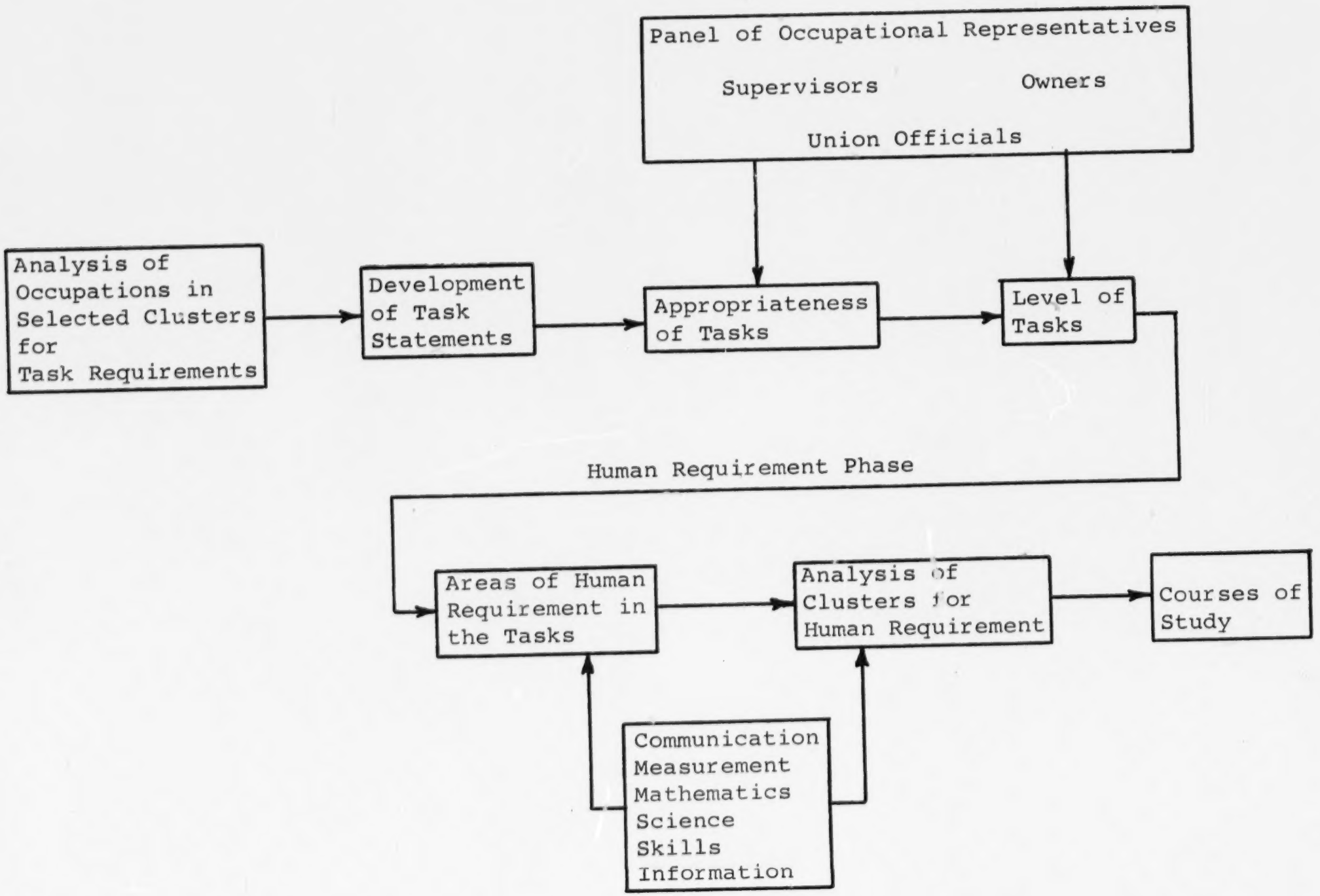
OCCUPATIONAL CLUSTERS

CHART III

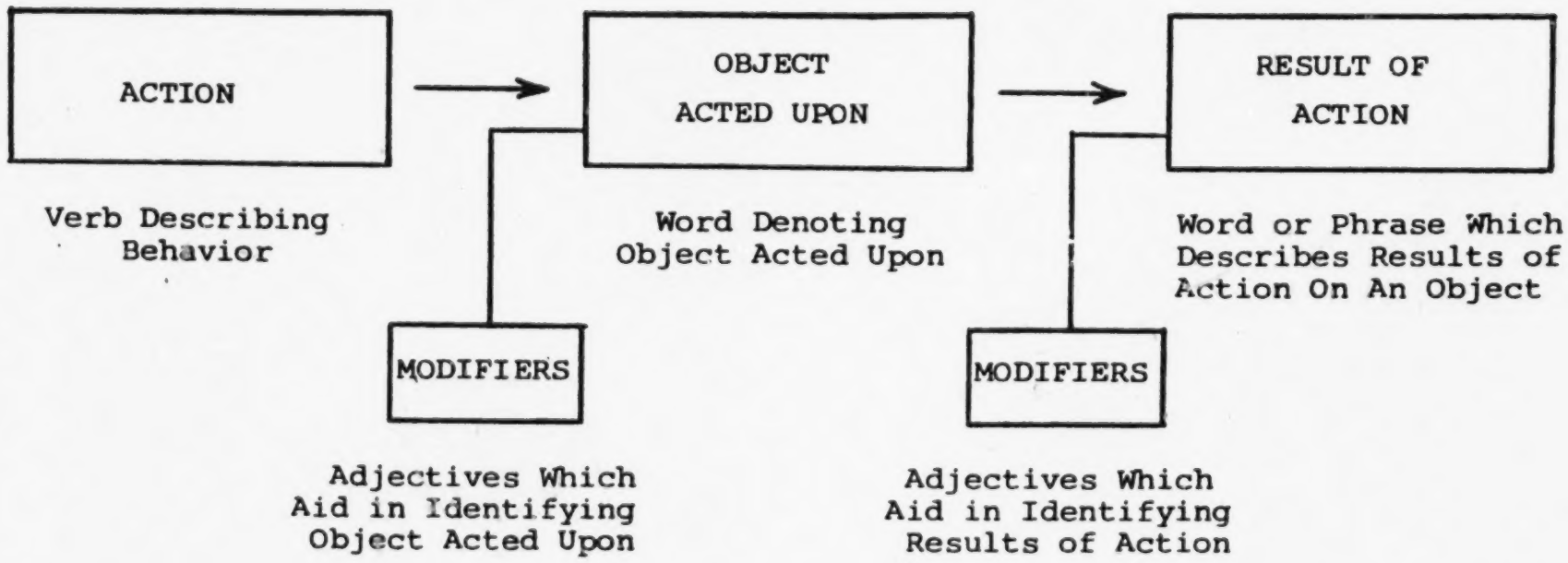
THE CLUSTER CONCEPT IN VOCATIONAL EDUCATION

THE COURSE DEVELOPMENT PHASE

CHART IV



Turning Aluminum Stock On an Engine Lathe To Produce a Taper



TASK STATEMENT FORMAT

CHART V

The appropriateness of these tasks for the particular occupations was established through a special panel of representatives from industry and business. This group consisted of supervisory personnel, business owners, and union officials. Their specific tasks included:

1. To determine the appropriateness of the task to the particular occupation, and
2. To establish the level of the task.

The level of the task was related to the need to perform the operation on two separate bases.

The first level tasks were to be those that would be needed to perform satisfactorily upon entering the job.

The second level task was of an additional or advanced requirement that would be needed within six months after job entry.

The results of the work of the panel of occupational representatives consisted of a series of task statements identified with either a "level I" or "level II" category. Chart VI contains a partial listing of such tasks for two occupations in a cluster.

A further analysis of these "level I and II" tasks was made in terms of the human requirements along the lines of communications, measurement, mathematics, science, skills, and information.

CLUSTER CLASS RECORD FORM

(This is a sample page from a total of six on these occupations)

CHART VI

TASK EVALUATION CHART

AIR CONDITIONING & REFRIGERATION SERVICING EXPERIENCES

Level	Task No.	Task Statement
II	1	Installing tubing between case and condensing unit.
I	2	Testing lines with detection device for leaks
II	3	Installing gages on condensing unit to charge the unit with refrigerant.
I	4	Evacuating the entire system with a vacuum pump to remove all non-condensibles.
I	5	Removing the cover from the unit for ease of servicing.
II	6	Replacing the defective components in the refrigeration unit.
I	7	Replacing the cover on the unit to restore to the original condition.
		BUSINESS MACHINE SERVICING EXPERIENCES
II	1	Observing the symptoms to determine the defects in a typewriter.
I	2	Disassembling the typewriter for cleaning.
I	3	Cleaning typewriter to remove dirt.
II	4	Isolating the mechanical defects to a particular section of the typewriter.
II	5	Isolating the electrical defect(s) to a particular component of the typewriter.
II	6	Isolating the mechanical defect(s) to a particular component of the typewriter.
I	7	Removing the defective part(s) of the typewriter.
II	8	Replacing the defective part(s) of the typewriter.
II	9	Reassembling the repaired typewriter.
II	10	Testing the operation of the repaired typewriter.

Student

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V

The combination of the task analyses and the human requirement analysis provided necessary data for the development of the courses of study which were the final aspect of the first year of the study. A tentative course of study was developed for each of the three clusters. These materials were further refined in the second phase of the project.

Phase II: Teacher Education and the Preparation of Curriculum Materials. This second year was designed to provide the instructional personnel, the physical facilities, and certain curriculum materials necessary to carry out an experimental field study of the cluster concept.

The first major task for the project team was to select the teachers for preparation. This aspect of the program was initiated by conducting a series of conferences with top level school administrators in four different counties. The persons contacted were superintendents of schools, and the counties included Frederick, Montgomery, Prince George's, and Washington. The supervisors of industrial education were brought into the picture at an early stage to facilitate the top level meetings as well as to secure their involvement in interpretation and explanation.

The actual selection of teachers involved a number of interrelated considerations.

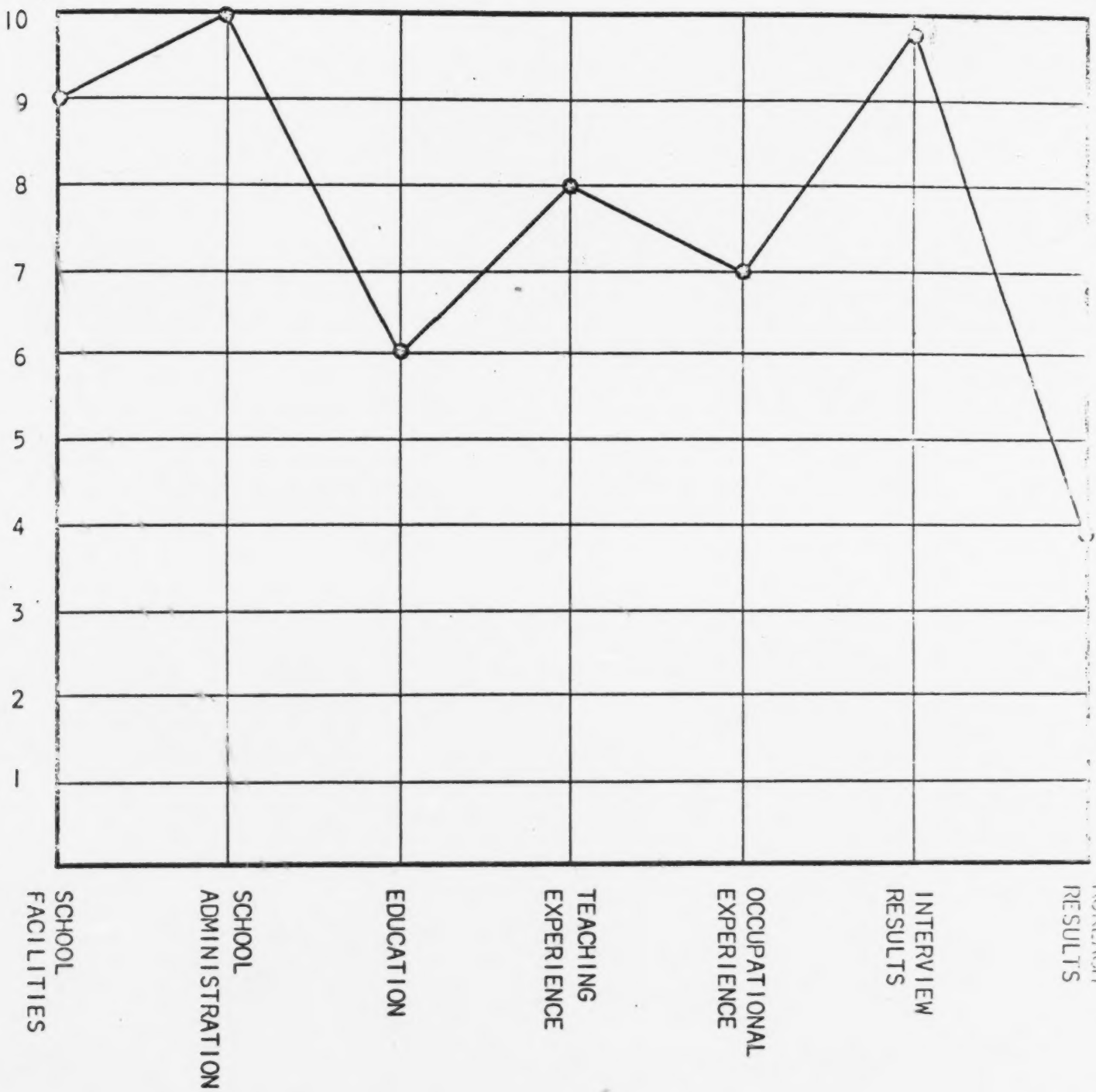
1. Each supervisor submitted a list of potential teachers from their respective counties, who they (the supervisors) thought would be capable of handling such a program. The list also included a number of persons who had expressed an interest in the program.
2. Group meetings were held with the identified teachers from each county. The purpose of the group meetings was to communicate the nature and purpose of the cluster approach to vocational education.
3. A series of individual interviews were held with the goal to get some appraisal of the candidate in terms of--

   commitment to teaching
   warmth
   cognitive organization
   orderliness
   indirectness
   ability to solve problems

The Rokeach Dogmatism Scale, Form E, was used to assess certain characteristics of each potential teacher.

The total teacher assessment involved the following data:

1. The results of the Rokeach.
2. The results of the interviews.
3. An evaluation of occupational experience.
4. The nature of the teaching experience.
5. The candidate's formal education.



Sample Teacher Profile

6. An appraisal of the school administration in terms of its acceptance and cooperation.

7. The school or laboratory facilities appropriate for the program.

The above data was presented on a profile chart for each candidate. The final selection of the teachers was based upon a careful study of the accumulated data on each prospective teacher by a committee consisting of the local supervisor, the Assistant State Director of Vocational Education, the Coordinator of the Cluster Project, and the Principal Investigator.

The initial selection resulted in all four of the counties having one teacher for each of the three clusters except Montgomery which did not have a person for the electro-mechanical installation and repair.

Teacher Preparation. The teacher education phase of the project extended over the Spring Semester and the Summer Session of 1967. The Spring Semester program was aimed at the following objectives.

1. Developing an understanding of the Cluster Concept as a program in vocational education at the secondary school level.

2. Developing capability in preparing objectives in behavioral terms.

3. Developing an understanding of the research procedures utilized in formulating content for the occupational clusters of the program.
4. Applying knowledge about the types and proper use of instructional materials for a cluster concept program.
5. Applying information about a range of instructional systems and methods appropriate for use in a cluster concept program.
6. Applying knowledge about a range of evaluation methods for use in a cluster concept program.

The instructional procedures used during the Spring Semester meetings included large groups, small groups, individual, and seminar sessions. Team teaching, educational media, self-analysis, independent study, class presentations, and class discussions were used in the instructional process.

The Summer workshop phase of the teacher preparation centered on two major objectives: (1) the development of the needed technical skills as well as the knowledge required to complement cluster concept programs; and, (2) the preparation of instructional materials needed to teach the occupational clusters.

The Summer workshop activities included internships in industries directly related to the teacher's cluster area, small group discussions and seminar sessions, instructional materials development, special technical training workshops, development of occupa-

tional information files, instructional aids workshops, industrial visitation, program development, and teacher education program development.

The teacher education - industry and business coordination and cooperation was an outstanding feature of the Summer program, and the teachers have since expressed a desire for further similar experiences.

One of the tangible products that resulted from this second phase of the "Cluster Concept" research effort was a tentative teacher preparation program. This material included a listing of the major topics to be covered, and a series of unit outlines under each topic. A number of resources were identified under each unit.

The major topics and sub-topics in the tentative teacher preparation program included the following:

I. Professional Competency Development for Cluster Concept Programs

   A. Cluster Concept Orientation

   B. Research Procedures Used in Determining Content for Occupational Clusters

   C. Task Analysis Techniques

   D. Preparation of Objectives in Behavioral Terms

II. Organization and Administration of Cluster Concept Programs

   A. Program Development

B. Methods of Teaching

C. Evaluation of Program and Curriculum

III. Technical Competency Development for Cluster Concept Programs

A. Development of Technical Skills in the Specific Cluster

IV. Instructional Materials Development for Cluster Concept Programs

A. Function of Instructional Media

B. Types of Instructional Media

C. Locating, Previewing, and Evaluating Commercially Prepared Materials

D. Construction of Materials

A second major accomplishment of the teacher education phase of the program was the reworking and improving of the course outlines to be used in implementing the program. A listing of equipment, tools, and physical facilities for each of the clusters was another outcome of this phase.

Finally, a number of teachers had been prepared to initiate pilot programs in their schools. Aside from the preparation of the teachers, a number of contacts were made with the local school counselors and administration to inform them of the program as well as to secure their cooperation in involving the school in the cluster activities.

Phase III: The Implementation and Further Development of Experimental Cluster Concept Programs through Actual Field Testing and Evaluation at the Secondary School Level. This third year of the project was an examination and evaluation of the cluster concept in a series of pilot programs conducted in the public secondary schools of four counties in Maryland. There were eleven different teachers and programs involved in the initial pilot programs. This number has been reduced to ten with the discontinuing of one of the programs in the electro-mechanical installation and repair cluster. The experimental cluster programs enrolled a total of 143 students. The following figures show the number of students in each program by clusters.

Program	Construction Cluster
1	15
2	16
3	16
4	14
Total	60

Program	Metal Forming and Fabrication
5	17
6	16
7	12
8	15
Total	60

Program	Electro-Mech. Inst. and Repair
9	13
10	9
Total	22

The programs for the most part were conducted in comprehensive senior high schools. One program was in a vocational-technical center associated with a comprehensive high school.

The major objective of the third year as well as the fourth year of the project was to test the cluster concept in experimental and pilot programs.

It was anticipated that such a field study would provide descriptive, comparative and quantitative data that would contribute to the further refinement of the cluster program as well as present additional information about the problems and advantages of such an experience.

The third phase of the project was conducted to determine the effectiveness of the cluster concept along the following lines:

1. The impact of the cluster concept program on selected cognitive, and affective behaviors, and the task performances (psychomotor behaviors) of students.
2. The adequacy and appropriateness of the content of the courses and instructional materials.
3. The educational process, its adequacy and appropriateness with special consideration for the administrative support, teacher effectiveness, and environmental conditions.

The research and evaluation activities centered on the three areas listed above. One of the initial steps was to develop and carry out a pre- and posttesting procedure.

Control and experimental groups were established for each of the programs involved in this study. This was done to get some insight into the effect that the cluster experience was having on the student. This procedure was conducted on an individual school basis.

The establishing of comparability or homogeneity was done through the use of intelligence test scores, lingual or verbal abilities and in one instance a mechanical reasoning test. An analysis of variance was used to determine if there were significant differences between the groups and the F max ratio was used to determine the homogeneity of variances.

Table I lists the areas tested (cognitive, affective and psychomotor) along with the instruments used.

The cognitive was examined through the use of a "Cluster Concept Achievement Test" developed by the research team. This was a special instrument aimed at the content of the three occupational clusters involved in this study.

The criteria used in the building of the test items were as follows:

1. The items must be based on the content of "level I" for the particular cluster.

TABLE I

VARIABLES OF PRE- AND POSTTESTS

Domain	Instruments	Factors Evaluated
Cognitive	Cluster Concept Achievement Test	Human Requirements* 1. Vocabulary 2. Measurement 3. Skills 4. Math and Science 5. Information
Cognitive	Mechanical Reasoning Differential Aptitude Test (The Psychological Corporation)	Applied science and mechanical reasoning
Affective	Minnesota Vocational Interest Inventory (The Psychological Corporation)	Interest patterns in relation to: 1. Carpentry field 2. Mechanical field 3. Electronics 4. Machinist 5. Painter 6. Plasterer 7. Sheet metal 8. Radio & TV
Cognitive	Occupational Information	Availability Status role Expectations Mobility
Psychomotor	Task Inventory Sheets	Performances of specific tasks derived from manipulative jobs required for each cluster.

*Based on analysis of occupations phase I and II.

2. The items must require a student to solve a problem or apply knowledges or skills.
3. The items must be practical with verbalism held to a minimum.
4. The items should reflect the "level I" human requirements as outlined in the courses of study.
5. The items should be of the multiple-choice type adapted to machine scoring.
6. A comprehensive test for each cluster was required.

The items were subjected to an item analysis as well as the Kuder-Richardson test of reliability.

A second test in the cognitive area dealt with the content in the area of occupational information. This test was developed by the research team.

A third test in the cognitive involved the D.A.T. Mechanical Reasoning Test.

The affective area of study involved the use of the Minnesota Vocational Interest Inventory.

The psychomotor dimension of the investigation involved the "Task Inventories" that were developed for each of the three clusters. Each set of inventory forms contained the "level I"

and "level II" tasks associated with a particular occupation within a cluster. These inventory forms provided the teacher and the student with a listing of tasks to be accomplished by the student. Such forms also provided space for the teacher's evaluation of the student's performance in the task. Each statement of the task was written in a behavioral objective form.

It also is important to indicate that the research team made numerous visits to each of the programs to observe and to assist whenever possible. The research team carried out a detailed analysis of the teaching situation in order that an accurate description could be made of the teaching, the school support, and the physical environment in which the program was being conducted.

The findings from the analysis of the cluster achievement tests revealed the following:

1. Three out of four of the construction cluster programs showed significantly higher scores over the control group.

   These three schools or programs showed important gains on the posttest over the pretest.

2. Significant gains were not achieved by the experimental groups over the control groups in the

electro-mechanical installation and repair cluster programs. Part of this was due to equipment and facility problems.

3. The cluster groups involved with the metal forming and fabrication occupations showed all four programs making significant gains. The experimental groups showed significantly higher scores than the control groups in this same cluster.

The pre- and posttest scores on the Minnesota Vocational Interest Inventory indicated no clear patterns or trends that one might attribute to the cluster approach. There were indications from the cluster groups towards a more flexible occupational choice as well as an interest in broad entry level skills.

The accomplishment in the task performances (psychomotor) varied within a single program as well as between programs in a given cluster.

Students in the construction clusters completed from thirty-four to sixty-seven percent of the tasks. It was felt by the teacher that from fifty to sixty-six percent of the attempted tasks would need further application the second year.

Students in the electro-mechanical installation and repair completed approximately half of the tasks. Two-thirds of these were marked for further teaching the second year.

The students in the metal forming and fabrication cluster completed from fifty to sixty-seven percent of the total tasks in that area. It was estimated that from twenty-five to thirty-four percent of the tasks would receive further attention the second year.

The performance of the tasks or the results of the cognitive tests were hampered by a number of serious problems,-- namely: inadequate physical plant; materials did not appear in time; tools and machines were late in arriving. Such problems severely cut back the time needed to practice the task to a point where the student felt competent in the requirement.

Another facet of the evaluation and analysis process involved the rating of each of the schools along the following lines.

a. Support by the administration.
b. Preparation of the teacher.
c. Adequacy of the physical facilities.
d. Instructional procedures.
e. Community involvement.

Each program (school, administration, etc.) was evaluated separately and certain relationships were recognized between the student's performance and the above school factors.

The positive outcomes from the experimental pilot programs were many and valuable.

1. The furnishing of an inventory of task statements to teachers, students, and parents provided a sense

of direction for the program, a list of expectations, and an excellent communication device.

2. The ingenuity and resourcefulness of some of the teachers gave further clues regarding the nature and kind of laboratory experiences appropriate for such a cluster program.

3. The nature and kind of laboratory facilities required for the effective pursuit of cluster programs was another important outcome.

4. The preparation and background of teachers was another area of valuable insights. The proper placement of teachers constituted a vital area of understanding that grew out of the study.

5. The nature and kind of support by the board of education, supervisor, and principal became important factors in the success and accomplishment of the individual programs.

The fourth and final year of the cluster concept project at the University of Maryland is titled The Implementation and Further Development of Experimental Cluster Concept Programs Through Testing and Evaluation Including Placement and Follow-Up of Subjects.

The areas of investigation in this phase were the same as for the previous year of implementation, with the addition of

one more objective. This fourth year program (currently in progress) also will attempt to establish the employability of graduates in those areas of occupational preparation represented in their individual clusters.

The placement and follow-up activities associated with the students who complete the cluster concept program will receive special attention in this final phase of the project.

This will involve the following:

1. Developing a comprehensive inventory on each of the students in the program.
2. Developing a comprehensive inventory of employment opportunities in the area with special reference to the qualifications of the student.
3. Informing the local business and employment groups regarding the nature and background of the cluster training.
4. Developing a rapport with the potential employers in an attempt to secure their cooperation in hiring the graduates from the program.
5. Developing follow-up and evaluation procedures to gather information about the student's performance on the job.
6. Providing for a further assessment of the total project and its operation in terms of--

a. concept development,
b. program development,
c. teacher education,
d. physical facilities,
e. evaluation procedures,
f. placement and follow-up,
g. precautions and improvements.

7. Providing the school with a variety of materials or services such as--

a. information to counselors on
   -- the students,
   -- the program,
   -- the job opportunities, and
   -- follow-up procedures.

b. evaluation instruments for the various clusters.

c. consultation to school administrators regarding the cluster approach.

d. suggestion for further cluster areas of occupational preparation.

e. consultation to the schools on matters of physical facilities, space, and materials.

f. literature and suggested readings on the cluster approach.

It is intended that certain activities will continue after this final year of the funded project. These include: assistance to schools; further evaluation studies; conducting placement and performance research; and the development of additional clusters.

Concluding Remarks: The cluster concept project at Maryland is in its final year in a four-year sequence of systematic study.

It started with a relatively new concept, many untried hypotheses, and a full range of developmental problems in the areas of cluster development, teacher education, teacher performance, physical plant development, curriculum materials, etc.

There has never been any delusion on the part of the originator of this project that the outcomes of the two-year experimental programs would provide a situation that could truly in a valid research context prove or disprove the effectiveness of a cluster approach to vocational education.

The uncontrolled variables of teacher performance, physical facilities, administrative support, pupil placement in the program, etc. make it impossible to attribute success or failure to the "program" as was developed for each of the clusters.

It will take refinement in all areas affecting the individual programs before a valid test could be made of the actual cluster activities developed in this project as a part of vocational education.

The progress, the aroused interest, and the increased knowledge that has stemmed from this effort to date have made it a worthwhile investment in education.

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